June 2, 1970 E. A. HOLLENBACH 3,515,300

FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 1

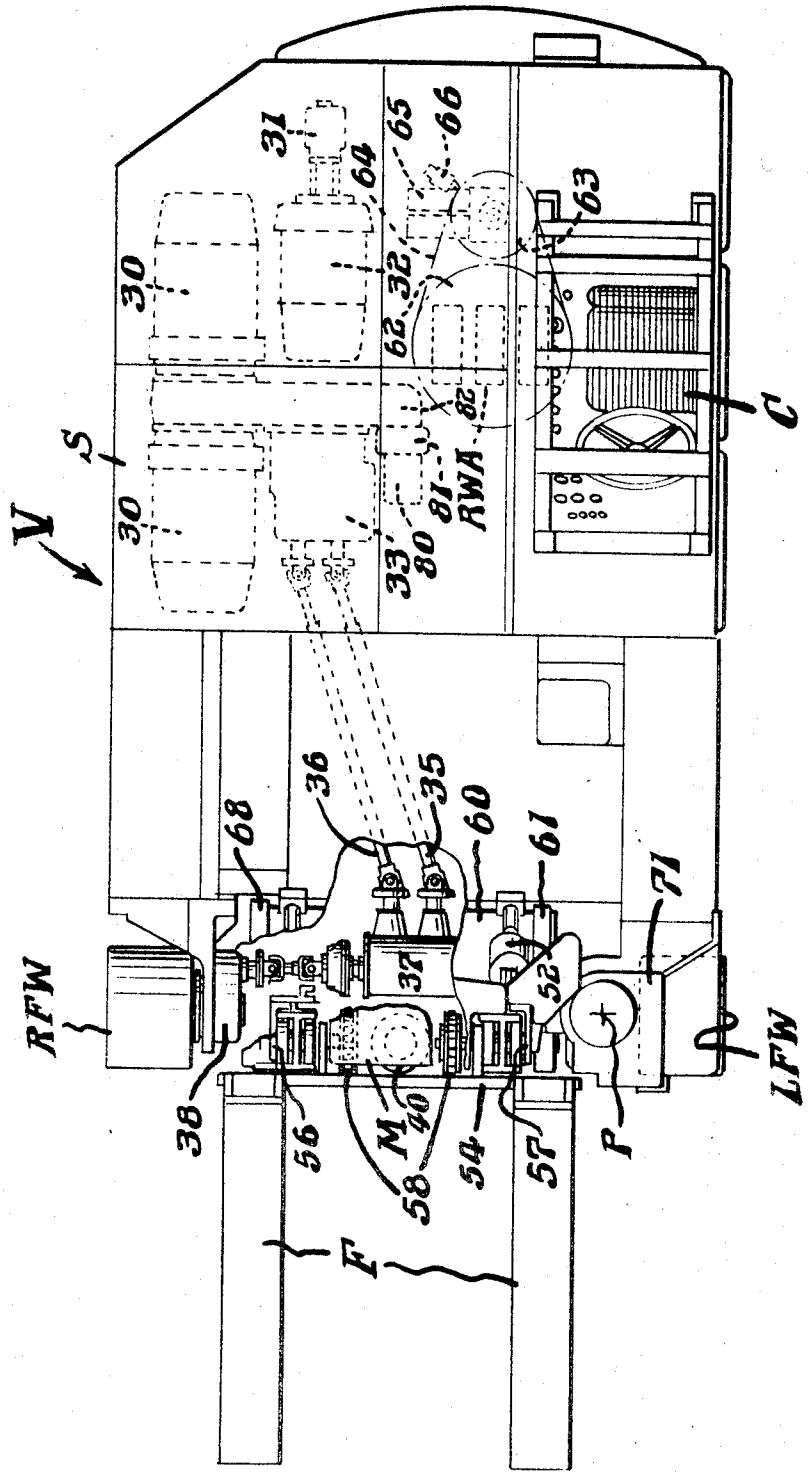


FIG. 1

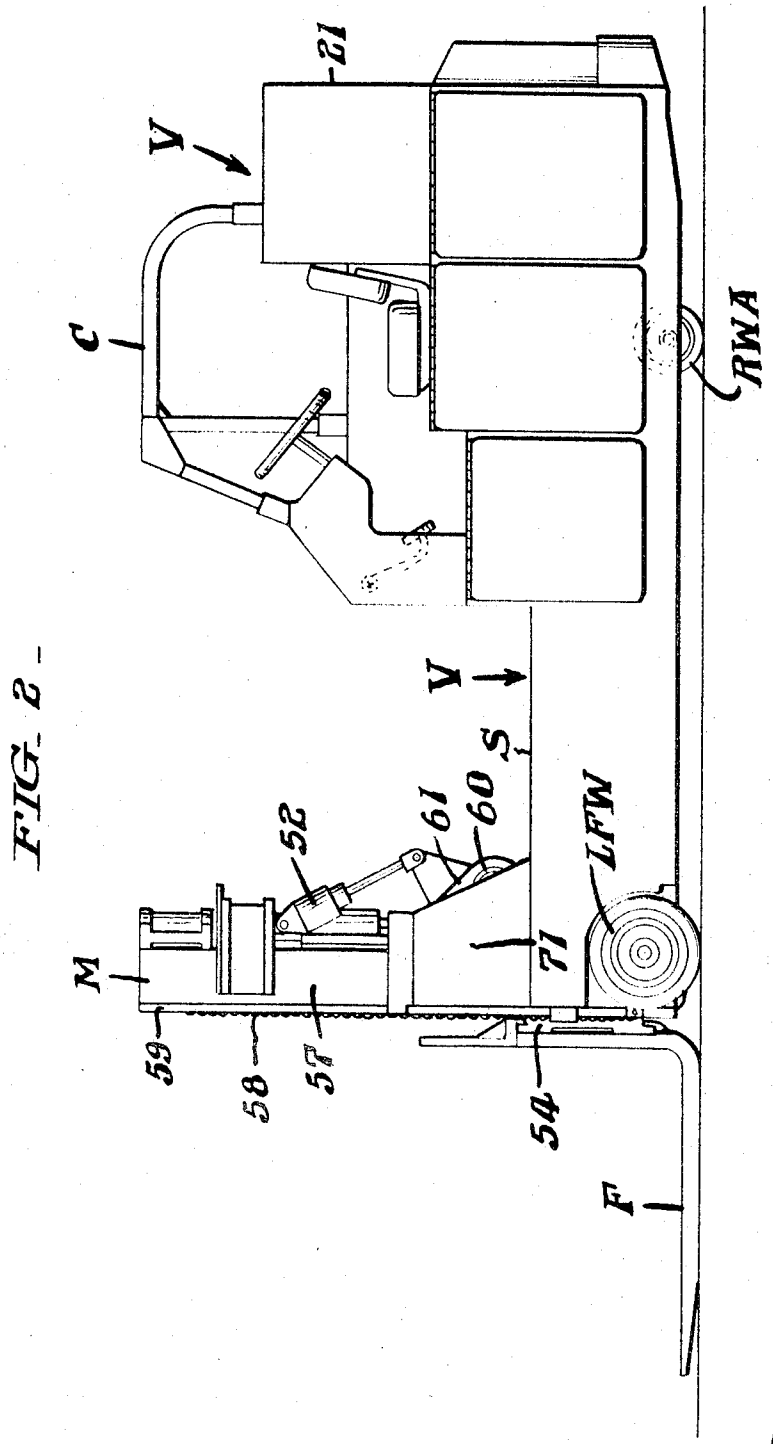
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 2

FIG. 2

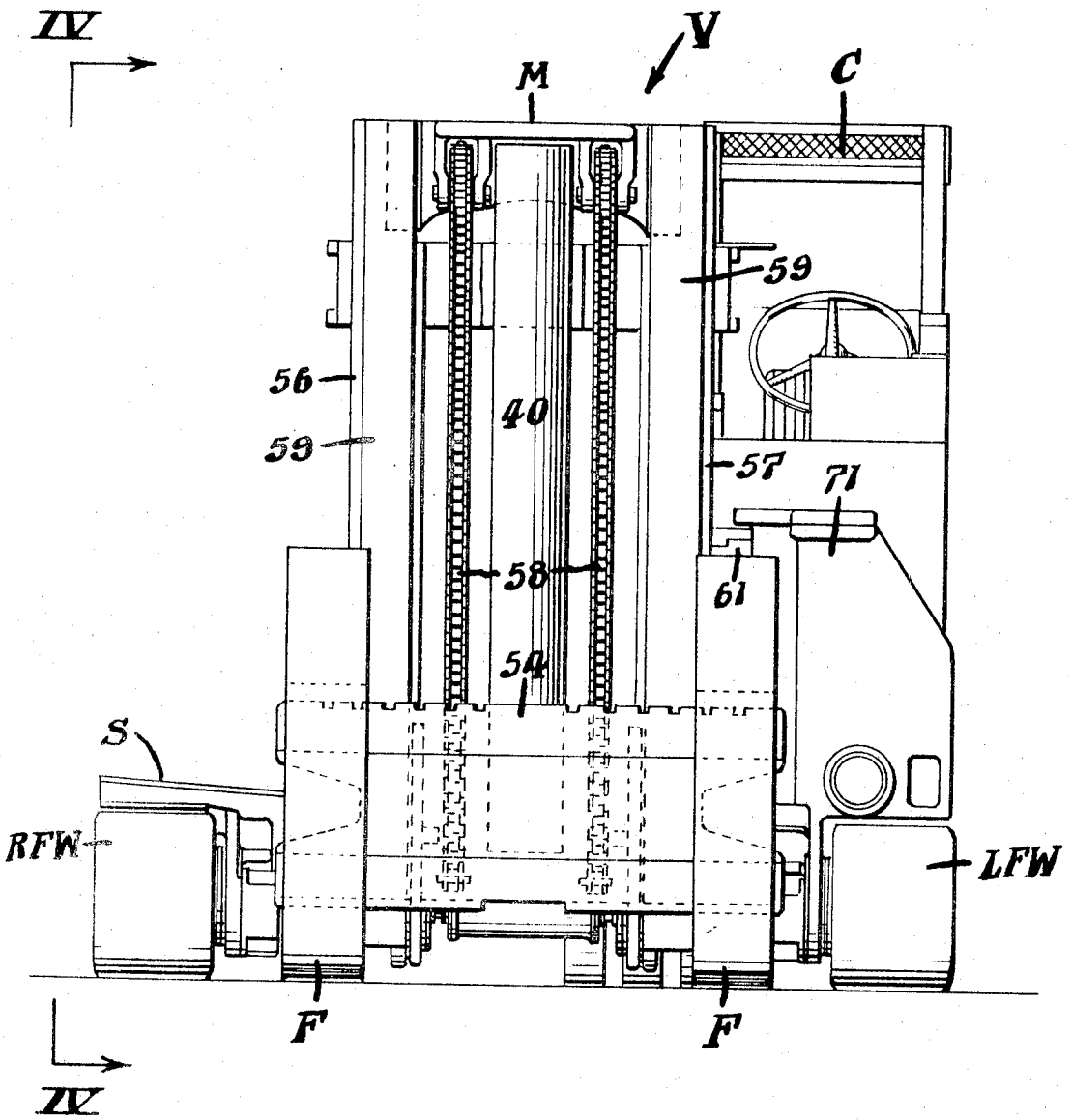


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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 3

FIG. 3



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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 4

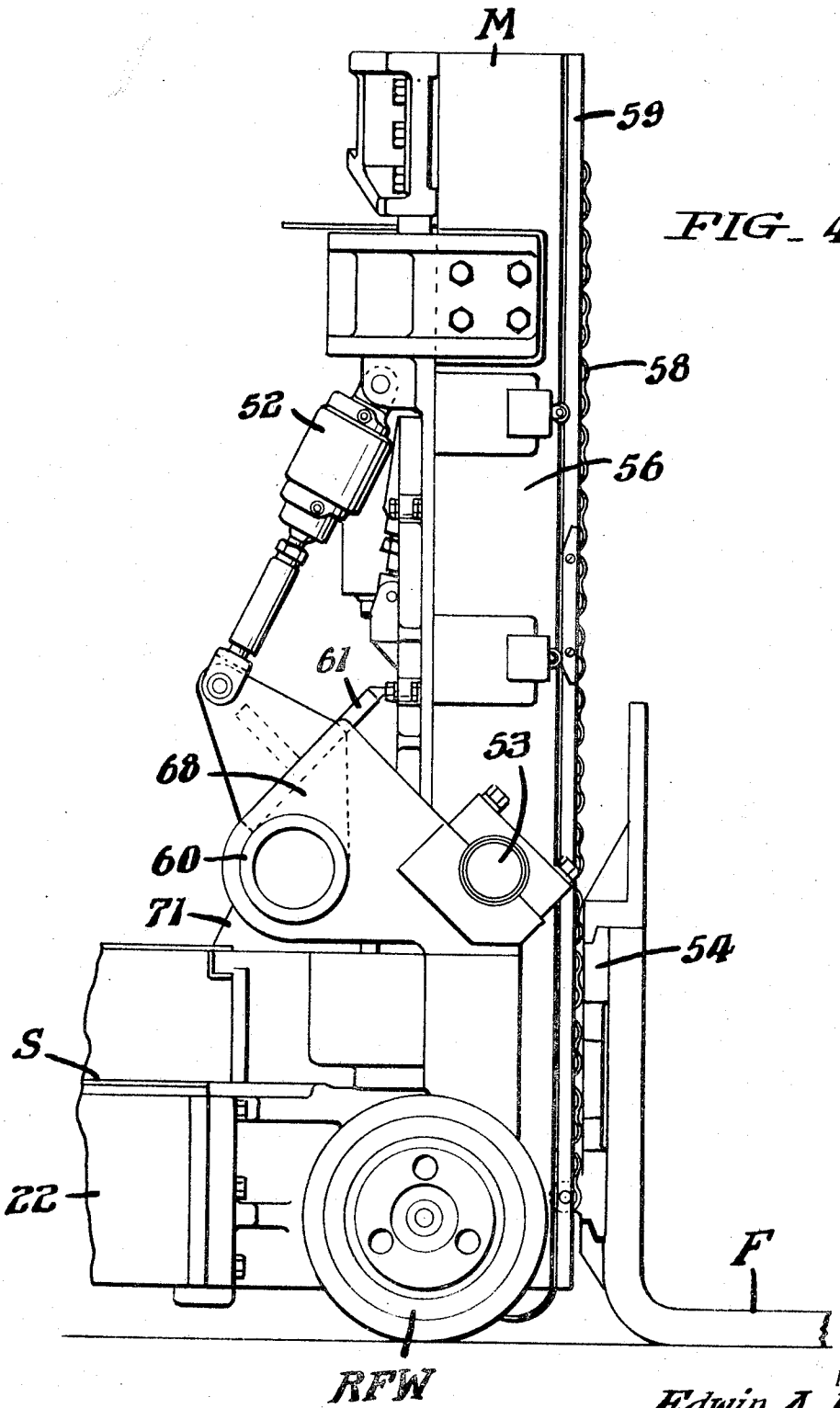


FIG. 4

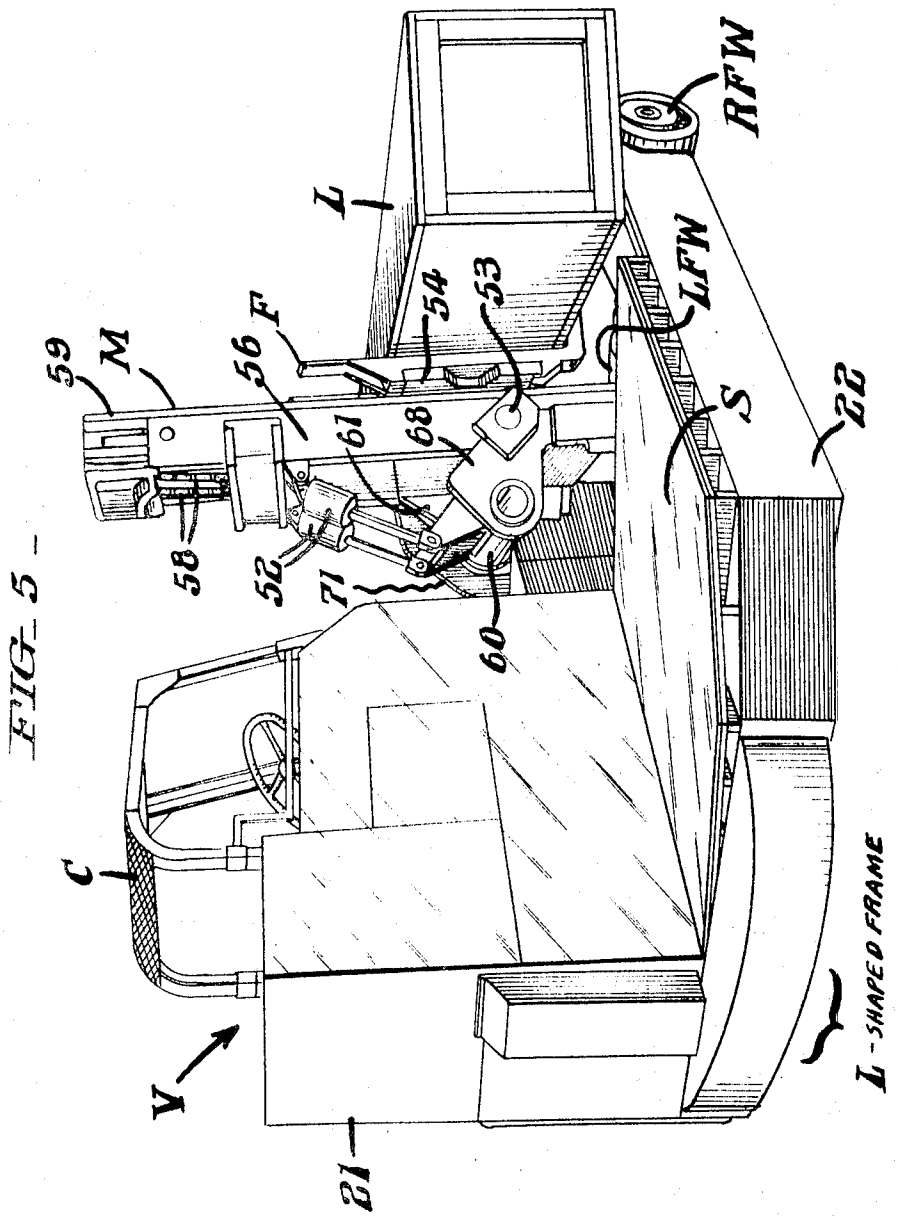
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 5

FIG. 5



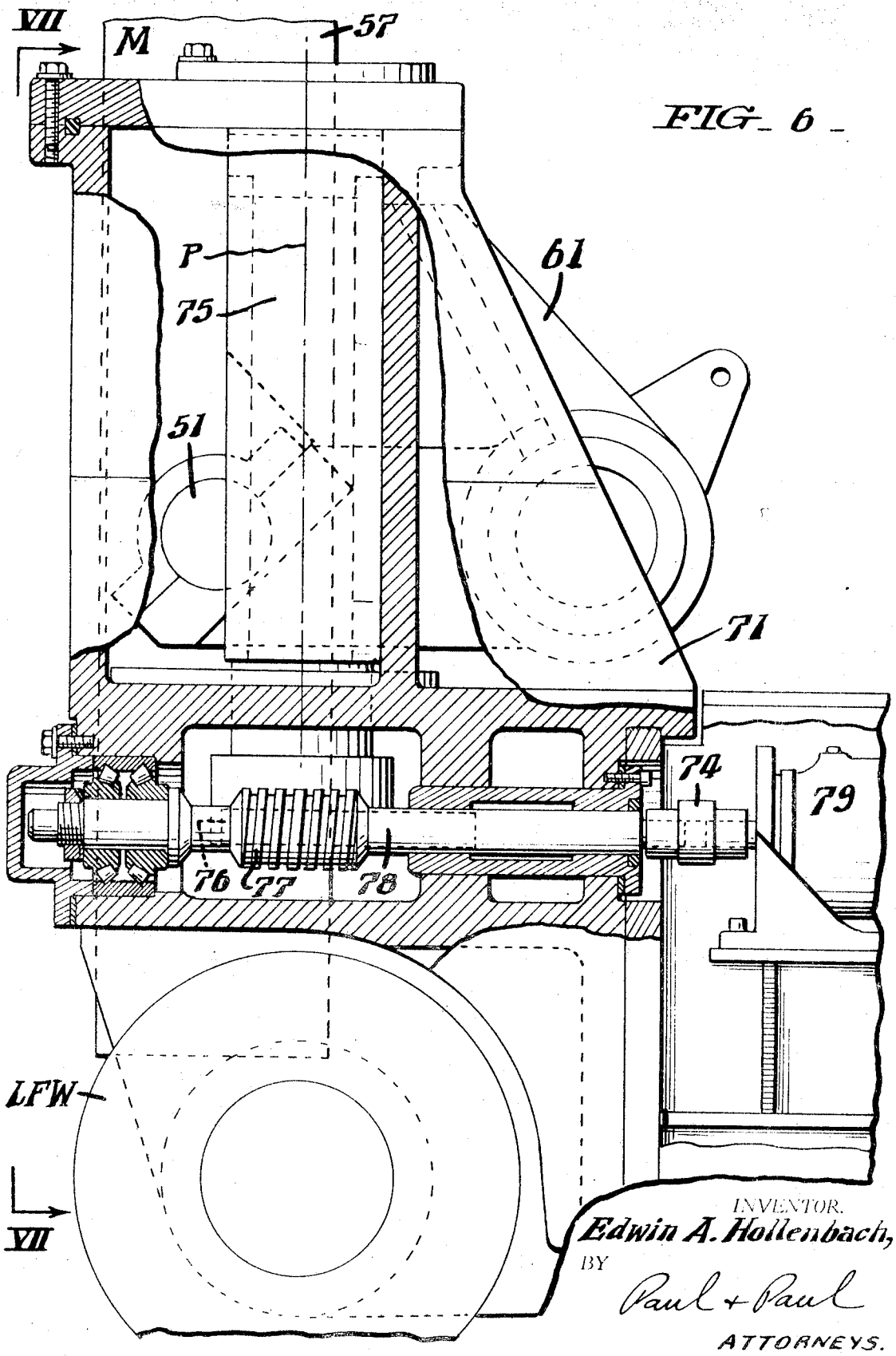
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

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FIG. 6



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June 2, 1970 E. A. HOLLENBACH 3,515,300

FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 7

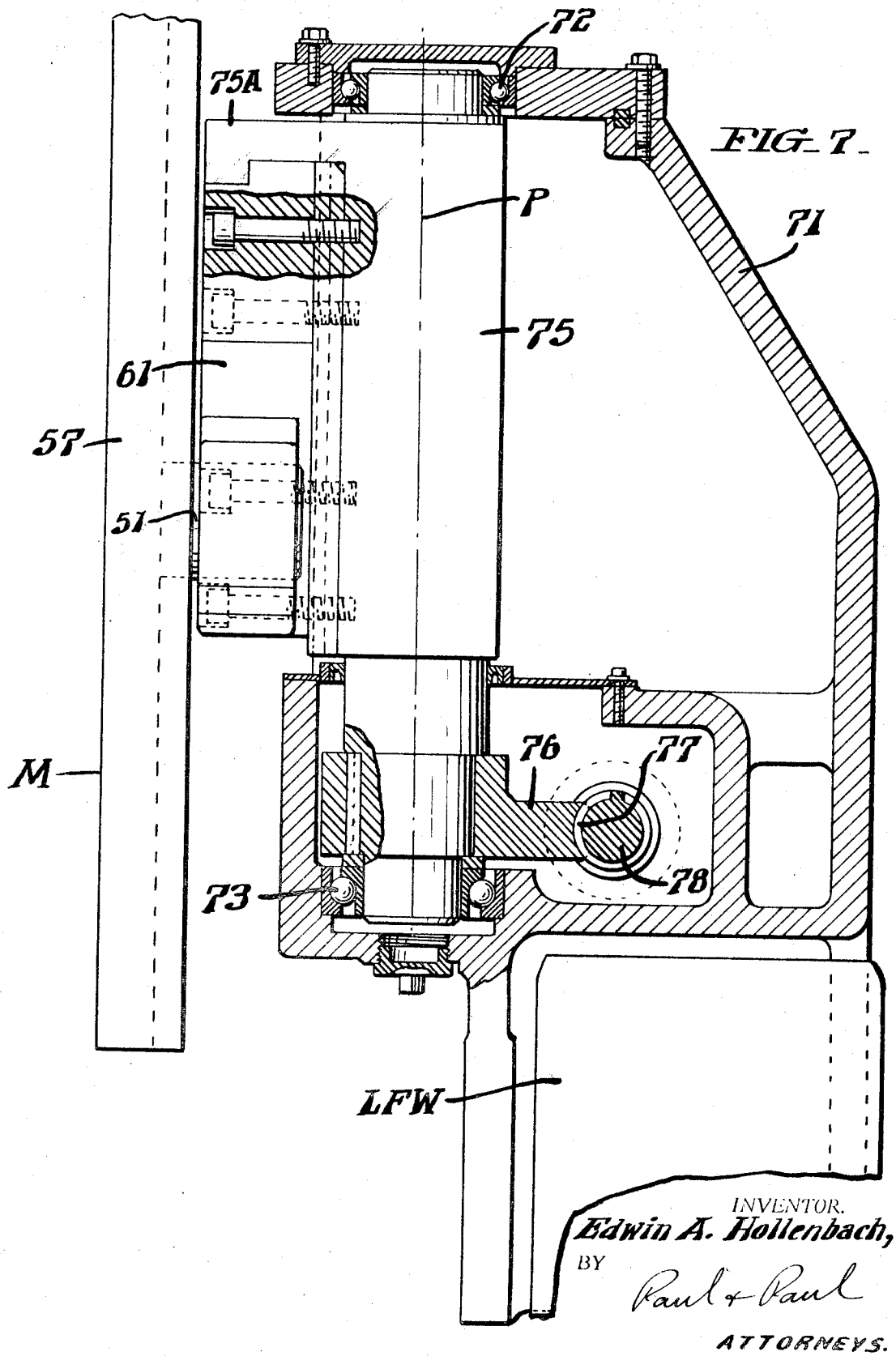
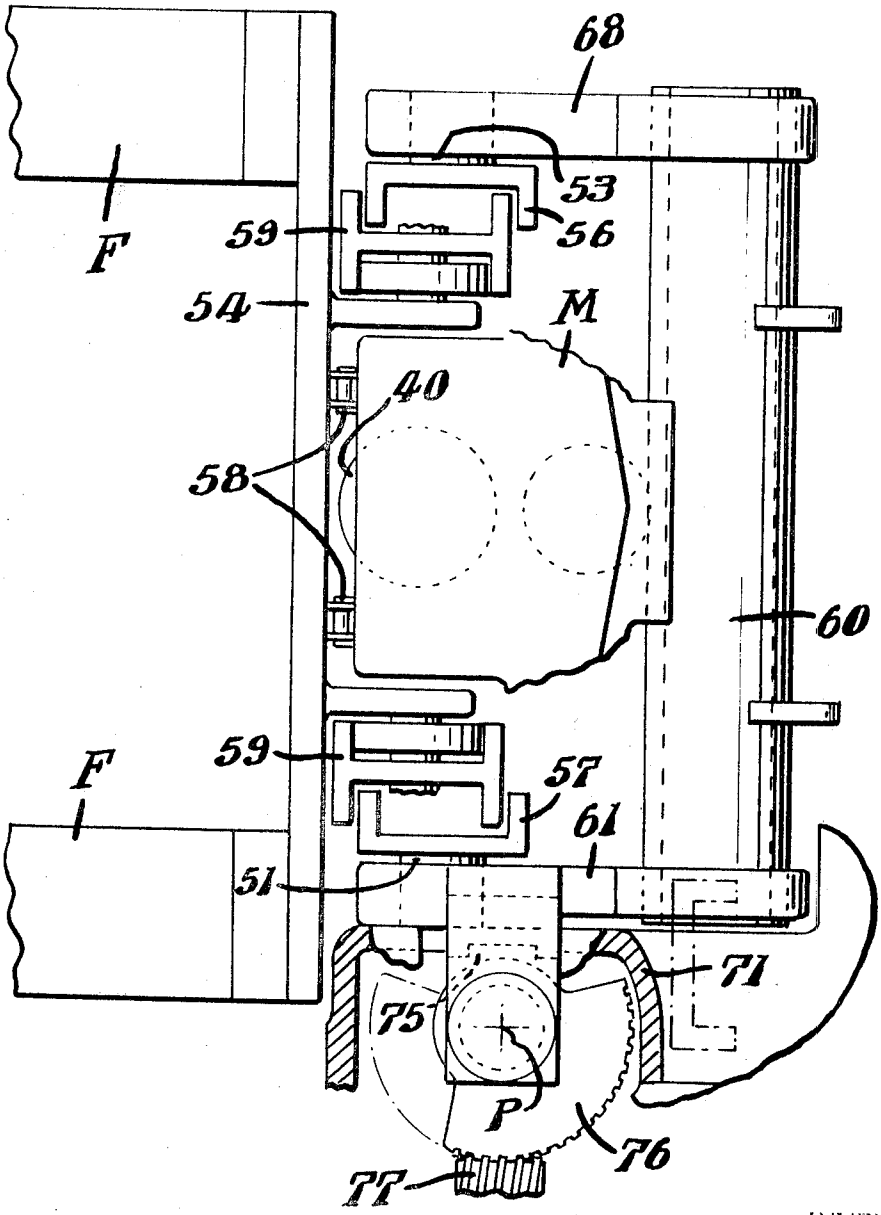


FIG. 7.

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FIG. 8



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June 2, 1970 E. A. HOLLENBACH 3,515,300

FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 9

FIG. 9

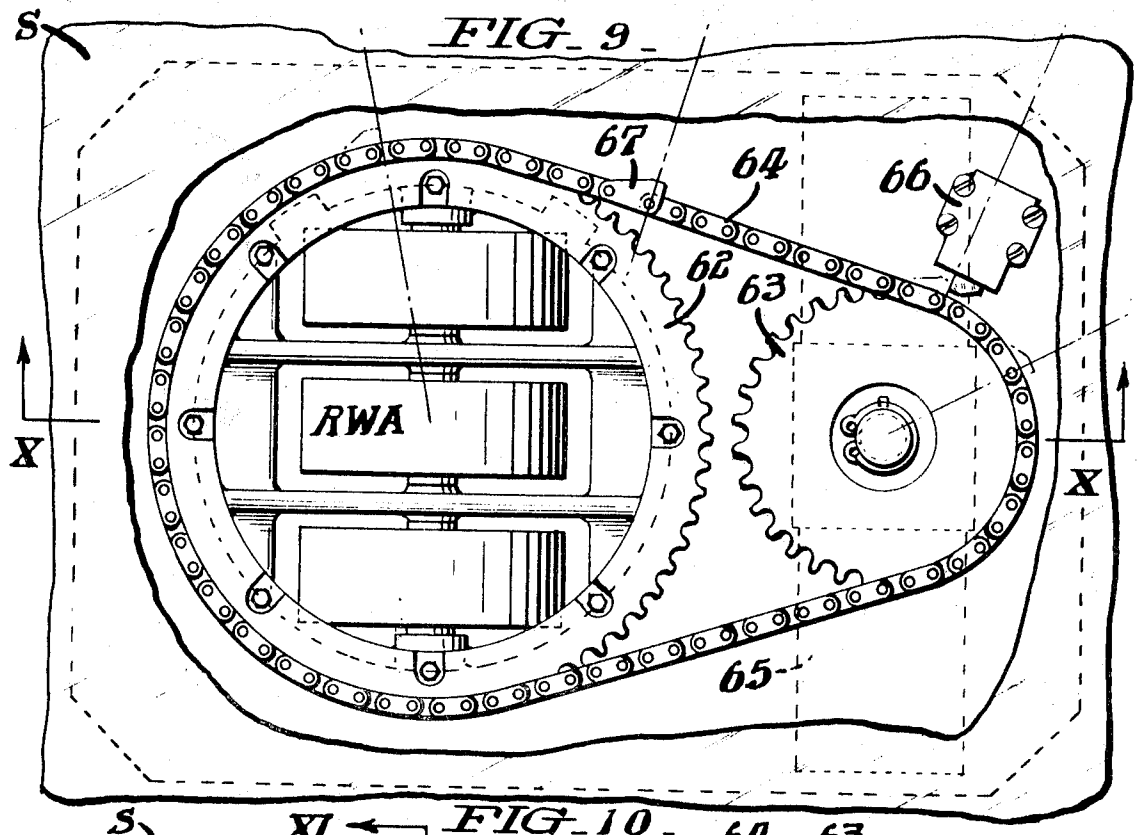


FIG. 10

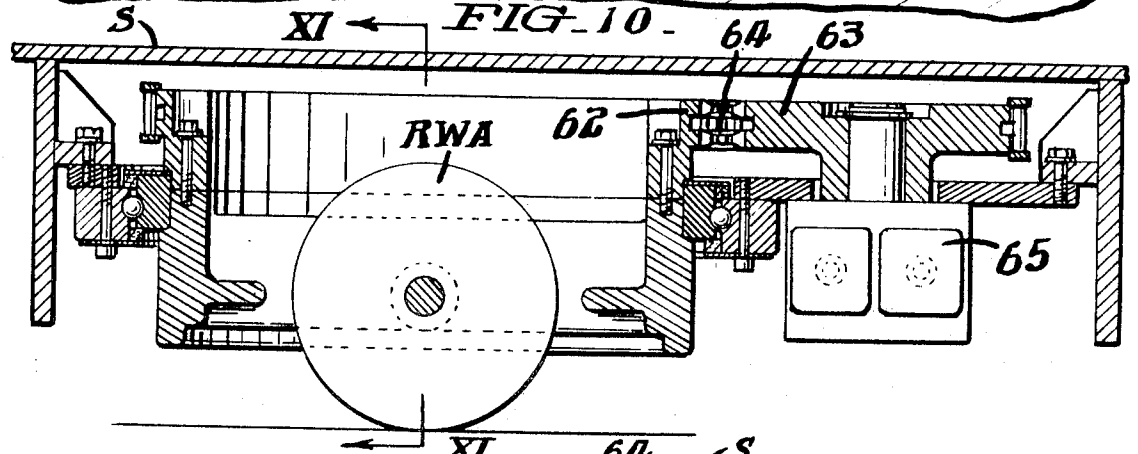
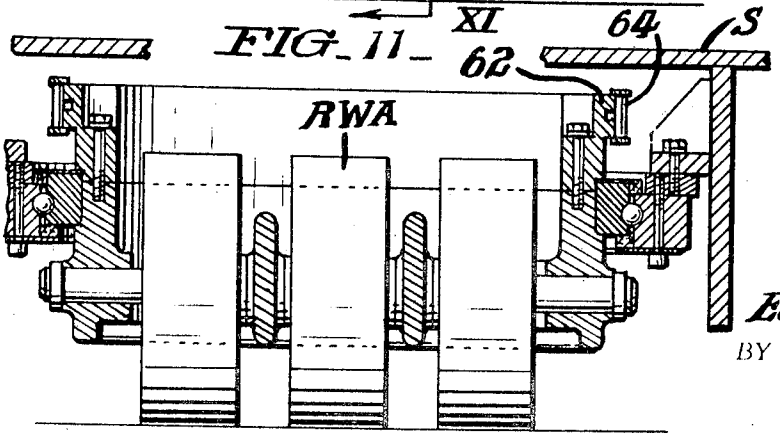


FIG. 11



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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 10

FIG_12_

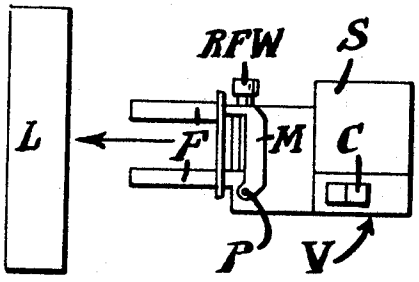


FIG_13_

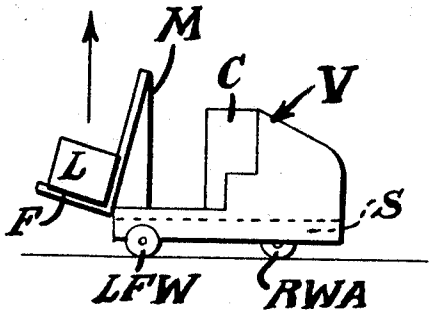


FIG_14_

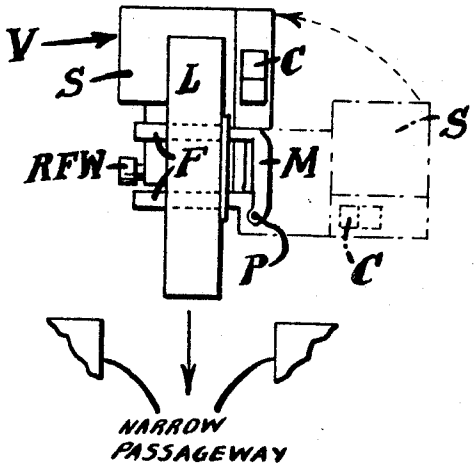
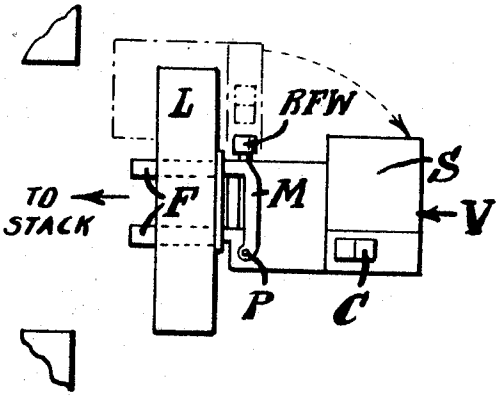


FIG_15_



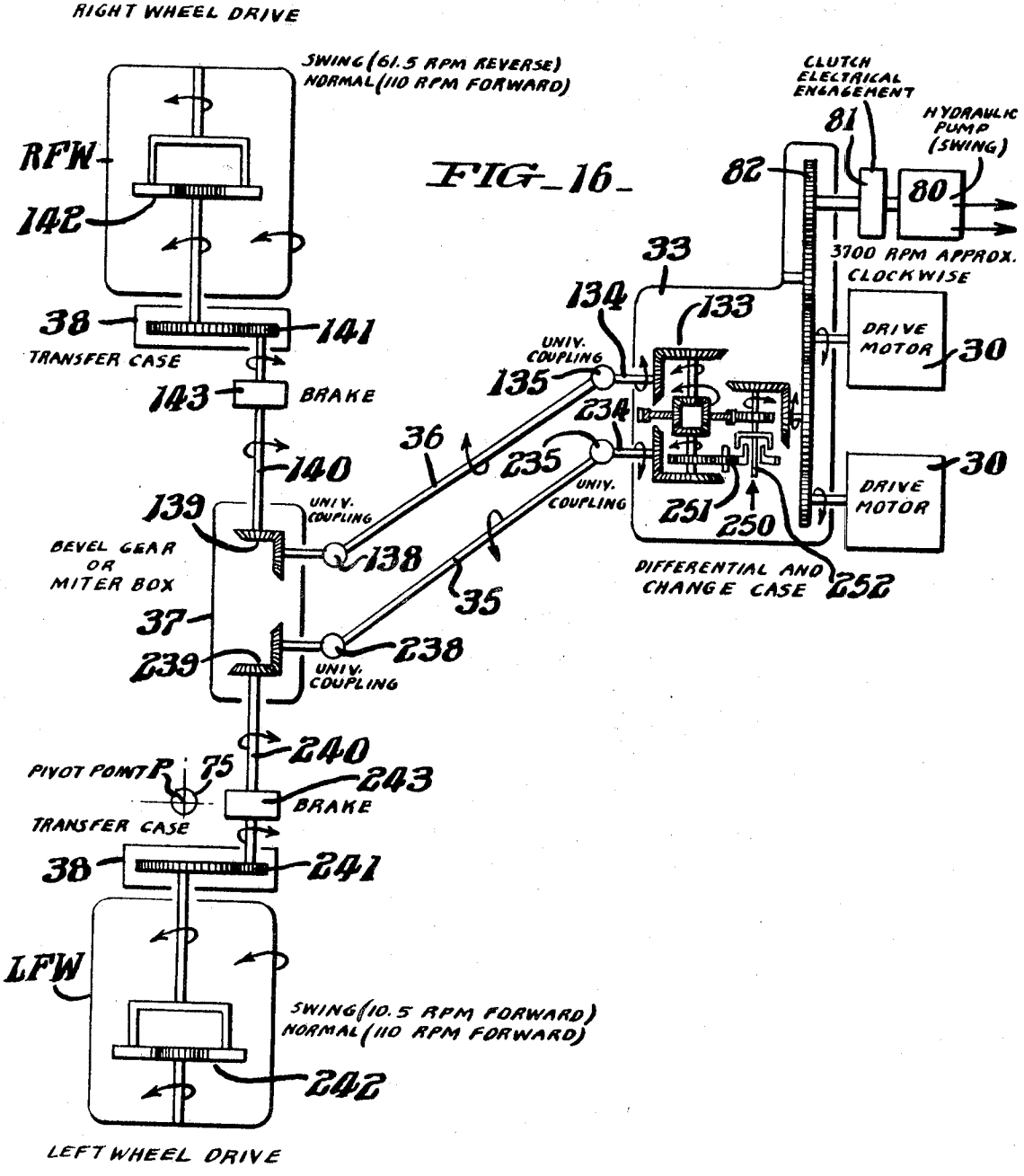
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 11

FIG_16_



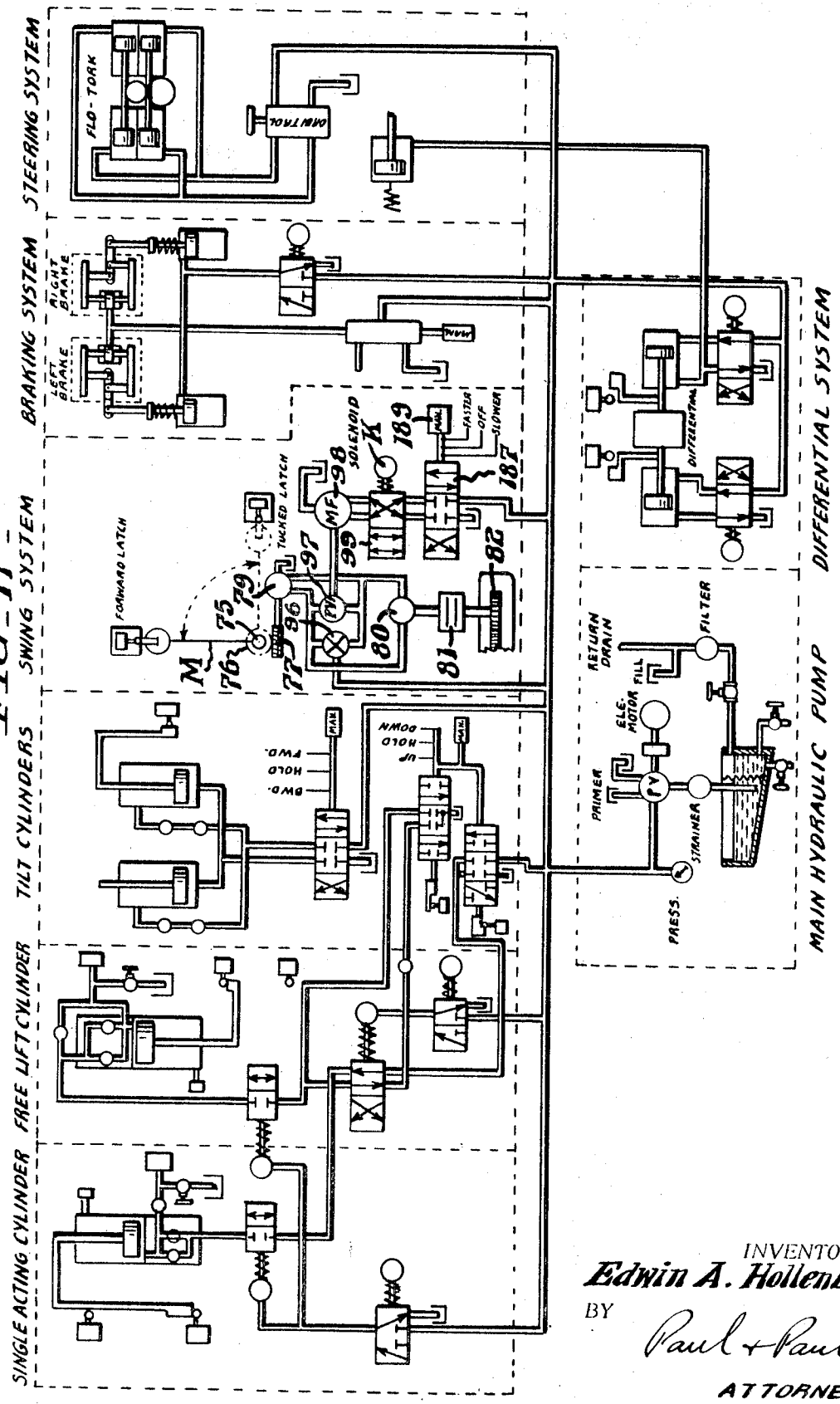
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 12

FIG. 17



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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 13

FIG_19_

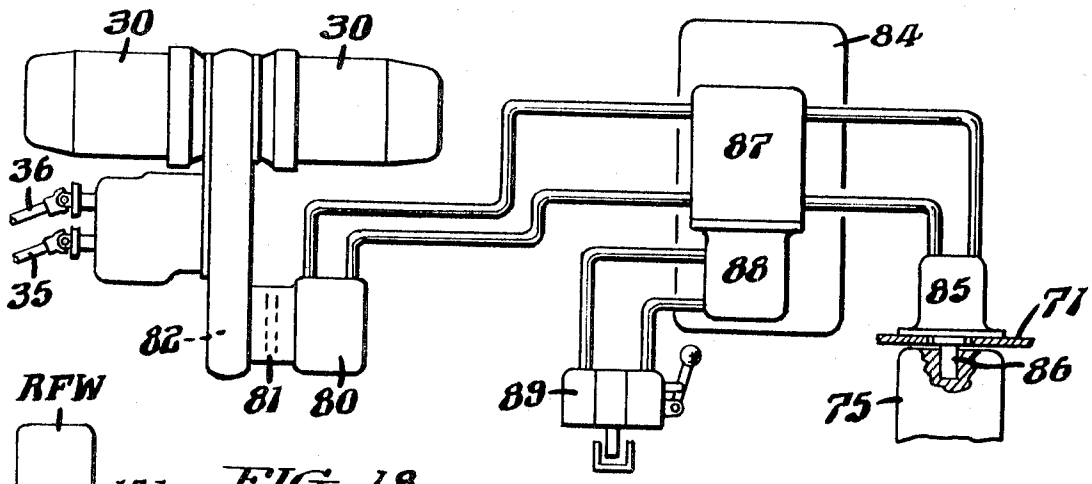
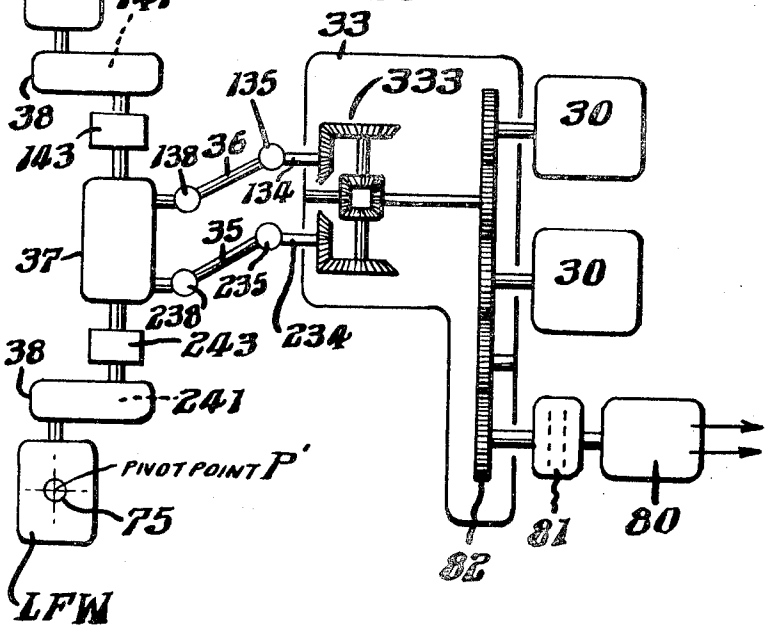


FIG_18_



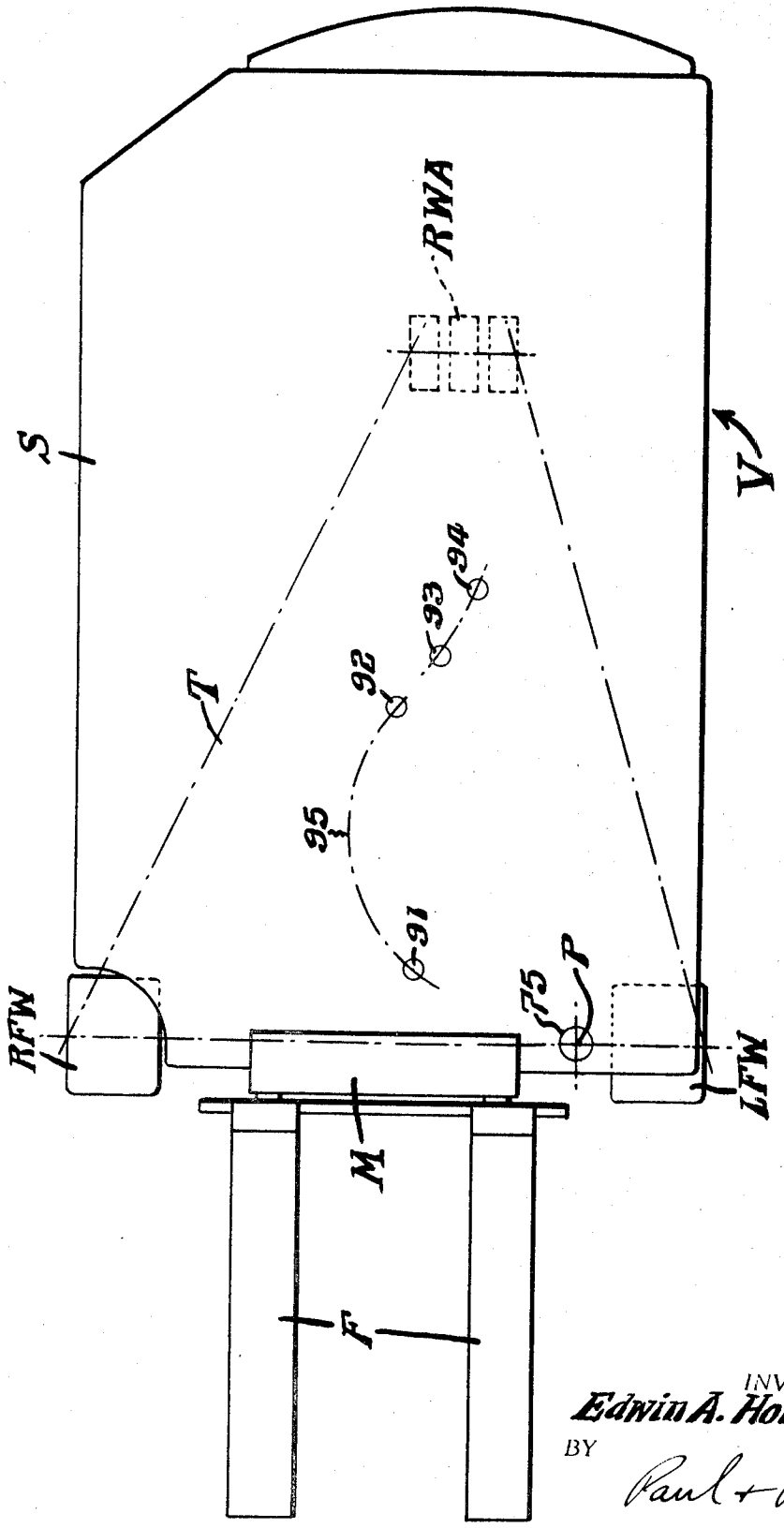
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FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Original Filed Aug. 6, 1965 14 Sheets-Sheet 14

FIG. 20



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United States Patent Office 3,515,300 Patented June 2, 1970

3,515,300

FORK LIFT TRUCK WITH A MAST PIVOTAL ABOUT A VERTICAL AXIS

Edwin A. Hollenbach, Paoli, Pa., assignor, by mesne assignments, to The Philadelphia National Bank, Philadelphia, Pa., a national banking association

Original application Aug. 6, 1965, Ser. No. 477,904. Divided and this application July 15, 1968, Ser. No. 760,374

Int. Cl. B65g 47/00

U.S. Cl. 214—671 1 Claim

ABSTRACT OF THE DISCLOSURE

A fork lift vehicle is disclosed having two spaced-apart front drive wheels and a steerable rear wheel assembly. A rotatable pivot post is vertically mounted in one front corner portion of the chassis over the center of one of the front wheels. The fork lift mast is cantilever supported across the front of the vehicle, to one side only of the rotatable pivot post. The vehicle is pivotally swung about the axis of the pivot post to "tuck" the load at the side of the vehicle, the fork lift mast and its load being maintained stationary relative to ground as the vehicle is swung under the fork-supported load.

This application is a division of parent application Ser. No. 477,904, filed Aug. 6, 1965, now abandoned, by Edwin A. Hollenbach, entitled "Fork Lift Vehicle."

This invention relates to a material handling vehicle.

More particularly, the present invention relates to a fork lift vehicle so designed that, for stacking the load or removing the load from the stack, the vehicle approaches the stack with the tines of the fork extended forwardly from the front of the vehicle, but for transporting the load after pick-up, as through narrow aisles or passageways, the vehicle is pivoted or swung under the load to "tuck" the load on to the side of the vehicle in a carry position which is lengthwise of the line of travel.

A principal object of the invention is to provide a fork lift vehicle of the above type in which the load is maintained stationary relative to ground as the vehicle is swung under the load.

Another object is to provide a fork lift vehicle of the foregoing type in which the pivot point, about which the vehicle is swung, is stationary.

A further object is to provide a vehicle of the foregoing type in which the pivot point is located on the line between two driven front wheels, close to one of the wheels.

A further object is to provide a vehicle of the foregoing type in which the pivot point is over the center line of one of the front wheels of the vehicle.

Another object is to provide a fork lift vehicle of the foregoing type in which the combined center of gravity of the load and vehicle swings in toward the vehicle as the vehicle is swung under the load.

Another object is to provide a vehicle of the foregoing type in which the combined center of gravity of the load and the vehicle remains within the triangulation formed by the two front wheels and a single rear wheel assembly, thereby to eliminate the need for any additional counterweighting to balance the load in the tucked position, and thereby permitting the lifting and transportation of heavier loads with a lighter weight vehicle.

Another object is to provide a fork lift vehicle of the foregoing type in which when the vehicle is swung under the load, the mast (which supports the fork and the load) is rotationally driven in proportion to the angular movement of the vehicle as measured by the revolutions of the wheels of the vehicle.

Still another object is to provide a vehicle of the foregoing type in which a manually operable compensator is provided to allow adjustment of mast rotation to compensate for slippage of the wheels on the floor or road surface.

Another object is to provide a vehicle of the foregoing type in which the load is cantilevered to one side of the king post about which the mast is rotated.

Speaking generally, the fork lift vehicle of the present invention combines into one vehicle the characteristic advantages of both front and side loading vehicles. It may be used to special advantage in the handling of loads of substantial length, since the space required to handle such loads is only that required to swing the vehicle under the elongated load. This is in contrast to some prior art vehicles in which the fork with its load is pivoted on the vehicle while the vehicle remains stationary, or to other prior art vehicles in which the load changes its position relative to ground when the vehicle is turned.

In the fork lift vehicle of the present invention, the load remains stationary relative to ground as the vehicle is swung from the forward to the tuck position. Moreover, the center of gravity of the load never leaves the wheel triangulation, thus providing full stability in rotation and handling.

The invention will be clearly understood from a consideration of the following detailed description of a preferred form of the invention illustrated in the drawings in which:

FIG. 1 is a plan view, partly broken away, of the fork lift vehicle of the present invention with the tines of the fork extending forwardly from the vehicle in the normal approach or stacking position;

FIG. 2 is an elevational left-side view of the vehicle of FIG. 1;

FIG. 3 is a front elevational view of the vehicle of FIG. 1;

FIG. 4 is an elevational view of a portion of the right side of the vehicle, looking along the line IV—IV of FIG. 3 in the direction of the arrows;

FIG. 5 is a perspective view looking at the vehicle from the right rear showing the vehicle partially under the load;

FIG. 6 is an elevational view, partly broken away and in section, of a portion of the left side of the vehicle at the pivot point;

FIG. 7 is a front elevational view, in section, at the pivot point, looking along the line VII—VII of FIG. 6;

FIG. 8 is a plan view, broken away, of the mast portion of the vehicle;

FIG. 9 is a plan view, broken away, of the pivotal drive for the rear wheel assembly;

FIG. 10 is a side elevational view, in section, of the rear wheel assembly pivotal drive, looking along the line X—X of FIG. 9;

FIG. 11 is a front elevational view, in section, looking along the line XI—XI of FIG. 10;

FIGS. 12, 13, 14 and 15 are diagrammatic representations showing how the fork lift vehicle of the present invention is used in the stacking and transportation of an elongated load;

FIG. 16 is a schematic representation of one form of drive system for the front wheels of the vehicle where the pivot point is between the front wheels, close to one of the wheels;

FIG. 17 is a schematic representation of one form of suitable hydraulic control system for a vehicle having the drive system of FIG. 16;

FIG. 18 is a diagrammatic representation of another form of drive system for the front wheels of the vehicle, where the pivot point is over the center of the left front wheel;

FIG. 19 is a diagrammatic representation of one form of fluid drive for rotating the king post;

FIG. 20 is a sketch showing the locations of the combined centers of gravity of the vehicle and load, for maximum and no load conditions, for the forward and tuck positions.

Referring now to FIGS. 12–15, the load is represented by the reference letter L, and V is the fork lift vehicle having a mast M, a fork F, a cab C, a side platform S, and three wheels, two in the front and a rear assembly centered in the rear. Only the right front wheel RFW is visible in FIGS. 12, 14, 15. The left front wheel LFW and the rear wheel assembly RWA is visible in FIG. 13. The pivot point about which the vehicle V is swung when it is moved from forward to tuck position is indicated by P. This is also the pivot point about which the mast M is rotated.

In FIG. 12, the vehicle V is shown approaching the elongated load L with the tines of the fork F extended from the front of the vehicle.

FIG. 13 is an elevational diagram showing the elongated load L on the tines of the fork F and elevated sufficiently to clear the side platform S of the vehicle.

FIG. 14 is a plan diagram showing the position of the vehicle V after it has pivoted about axis P from the forward or stack position, shown in dot-and-dash line, to the "tuck" or carry position, shown in solid line. It will be seen, in FIG. 14, that the elongated load may be moved through the narrow passageway in the direction of the arrow.

In FIG. 15, there is shown in solid lines the position of the vehicle after it has pivoted around the pivot axis P from the dot-and-dash carry position to the approach and stack position. The elongated load L is now again at the front of the vehicle, and the vehicle is free to move forward in the direction of the arrow to the stack.

FIG. 5 is a perspective view of the fork lift vehicle of the present invention, as seen from the right rear, partially swung under the elongated load L. The vehicle includes a generally L-shaped frame having a vertical leg **21** which carries the cab C, and a lateral leg **22** which carries the side platform S. Platform S receives and bears the load L when the truck is swung under the load for carry down a narrow aisle.

In FIG. 5, the truck is illustrated as partly turned under the load L, as is indicated by the position of the right front wheel RFW. Neither of the front wheels is steerable. In one embodiment, in which the pivot point P is over the front drive shaft between the front wheels but close to the left front wheel, pivoting of the vehicle about the pivot point P to swing the vehicle under the load is achieved by rotating the right front wheel forwardly, rotating the left front wheel rearwardly at a reduced rate, and turning the rear wheel assembly RWA to the necessary angular position. In another embodiment, in which the pivot point P is directly over the left front wheel, the left front wheel is locked and the vehicle is pivoted thereabout.

When the vehicle is pivoted about point P, and depending upon the weight of the load, the level of the ground, and other factors, there may be some tendency for the mast M to pivot about the point P in the same direction of rotation as that of the vehicle. Such rotation of the mast and load is not desired, and, accordingly, means are included for automatically rotating the mast M about the pivot point P in a direction counter to that in which the vehicle is swinging, thereby to hold the mast M and the load L stationary, relative to ground, as the vehicle is swung under the load.

Projecting forwardly from the left side of the vehicle, in front of the cab, is a housing **71** which supports therein a king post **75**, vertically disposed for rotation about a vertical axis P, this being the pivot point P referred to in connection with FIGS. 12–15. Secured to the king post **75** is the left support casting **61** (FIGS. 7 and 8). Casting **61** lies in a vertical plane and extends in the forward to rearward direction. Secured pivotally to the forward portion of the casting **61**, as by trunnion **51**, is the left outer support member **57** of the mast M. The rearward portion of the casting **61** supports the horizontally and transversely disposed support cylinder **60**. Cylinder **60** is supported at one end only. The outward end of the cylinder **60** supports the right support casting **68** (FIG. 8), and pivotally secured to the casting **68**, as by trunnion **53**, is the right outer support member **56** of the mast M.

It will be seen from the foregoing that the mast M is supported in cantilever manner from the king post **75**, about which it is rotatable.

In FIG. 5, the reference numeral **52** indicates the tilt cylinders which control the vertical disposition of the mast M. Retraction of the pistons of the tilt cylinders causes the mast M to pivot about trunnions **51** and **53**.

FIG. 2 is a side elevational view of the left side of the fork lift vehicle showing the fork F extending from the forward end of the vehicle in the lowered position. The fork F is fastened to a carrier **54** which is elevatable by means of a pair of roller chains **58**. Before the vehicle is swung under the load L, the fork F is lifted to a sufficient elevation to clear the side platform S of the vehicle.

FIG. 1 is a plan view of the fork lift vehicle of FIG. 2, in which the fork F is shown in the approach or stack position, extending forward of the front wheels. In the embodiment now being described, the pivot point P, about which the vehicle swings, is the center axis of the vertical king post **75**.

Depicted in FIG. 1, in dotted lines, are the traction motors **30**, the transfer case **33** housing the differential and change gears, and the drive shafts **35** and **36** through which the front wheels are driven. Also shown in dotted lines are the pump **31**, the pump motor **32**, the three-unit rear wheel assembly RWA, the driven sprocket **62** which pivots the rear wheel assembly, the driving sprocket **63**, the chain **64**, the fluid motor **65**, and the limit stop **66**. In the broken-away section of FIG. 1 are shown the bevel drive unit **37**, and the right-wheel reduction gear case **38**, as well as other parts previously identified.

FIG. 4 is a slightly enlarged elevational view of the right side of the mast M, showing the outer right support member **56**, one of the telescoping support members **59**, the fork carrier **54**, one of the roller chains **58** which elevates the carrier **54**, the tilt cylinders **52** which tilt the mast M, and one of the tilt trunnions **53** about which the mast is pivotal.

FIG. 6 is a side view, enlarged, and partly broken away, of the portion of the vehicle above the left front wheel LFW. Extending forwardly from the left side of the vehicle chassis is the housing **71** in which is supported the king post **75** which is rotatable about its vertical axis or pivot point P. It is about point P, the axis of the king post **75**, that the vehicle pivots as it swings under, or away from the load L. Point P is also the point about which the mast M is rotatable. Pivot post **75** is of generally square cross section, but its ends are cylindrical and supported in suitable upper and lower bearings **72** and **73** respectively (FIG. 7). Extending transversely inwardly from the upper end of the square cross-sectional portion of post **75** is a flange portion **75A**, seen best in FIG. 7.

In the embodiment now being described, a worm wheel **76** is keyed to the lower cylindrical end of post **75**, above the lower bearing **73**. Worm wheel **76** engages a worm **77** which is keyed to worm shaft **78**. Shaft **78** is coupled by coupling **74** to a fluid motor **79**. Thus, rotation of worm wheel **76** rotates the pivot post **75**. As best seen in FIG. 8, the pivot post **75** supports the left casting **61** which supports the transverse cylinder **60** in cantilever fashion, and cylinder **60**, in turn, supports the right casting **68**. Since the mast M, with its fork F and load L, is supported on the trunnions **51** and **53**, which are supported in the castings **61** and **68**, it will be seen that when the pivot post **75** is rotated, the mast M and fork F are rotated about the pivot point P (FIG. 8).

FIG. 7 is a front elevational view, partly in section of

the housing **71** showing the worm **77**, the worm wheel **76**, the pivot post **75** journaled in the bearings **72** and **73**, and showing the left outer support member **57** of the mast M pivotally supported in the casting **61** which is bolted to the square cross-section portion of pivot post **75**.

FIG. 3 is a front elevation showing the cab C on the left side of the vehicle (to the right as viewed in FIG. 3) and rearward of the housing **71** (in which the king post is supported close to the left front wheel LFW). FIG. 3 also shows the fork F, the elevatable carrier **54** to which the fork is secured, the elevating cylinder **40**, the pair of roller chains **58**, the right and left outer support members **56** and **57**, and the telescoping members **59** which are slidable up and down in the outer support members.

FIG. 8 is a plan view of the mast M, showing a portion of the fork F, the tilt trunnions **51** and **53**, the left support casting **61** and the cantilevered cylinder **60** which supports the right support casting **68**. Also shown are the outer support members **56** and **57**, the telescoping members **59**, the elevator cylinder **40**, the king post **75**, the pivot point P, the worm wheel **76**, and a fragment of the worm **77**.

FIGS. 9–11 show the rear wheel assembly RWA as comprised of three unit wheels mounted on a common axle. To swing the vehicle from the forward to the tuck position, the operator turns the rear wheel assembly angularly to its limit position, prior to, or concurrently with, driving the right front wheel forwardly. The rear wheel assembly RWA is turned, by driving the sprocket **63** rotationally in the proper direction, as by means of the fluid motors **65** shown in FIG. 10, thereby driving the chain **64** and rotating the sprocket **62**. A stop lug **67** on the chain **64** is adapted to engage the limit stop **66**, thereby establishing the limit position for the rear wheel assembly.

The fork lift vehicle V is provided, in the form now being described, with a front wheel drive. FIG. 16 illustrates one form of suitable drive system. In FIG. 16, the pivot point P, about which the vehicle swings as it is moved from forward to tuck position, and vice versa, is indicated as being located on the line between the two front wheels, close to the left front wheel. This location of the pivot point P corresponds to the axis of the king post **75**. The front wheels are driven by a pair of drive motors **30**, driving through the differential and change gearing **133** in housing **33**. The differential and change gearing **133** is coupled to the right front wheel by way of output shaft **134**, universal coupling **135**, drive shaft **36**, universal coupling **138**, bevel gearing **139**, shaft **140**, transfer gearing **141** and the right wheel drive **142**. The differential gearing **133** is connected to the left front wheel LFW through output shaft **234**, drive shaft **35**, etc.

When the vehicle is to be swung from the forward to the tuck position, or vice versa, about the pivot point P (FIG. 16), the lock-out clutch **250** in the differential casing **33** is actuated to drive the gear **251** directly from the shaft **252**. This has the result of driving drive shaft **35** in a direction of rotation opposite from that shown by the solid line arrows in FIG. 16, and the left front wheel is therefore driven in the reverse direction from that in which the right front wheel is driven. The gear change arrangement in casing **33** is so selected that when the left front wheel is driven in the reverse direction from that of the right front wheel, the left wheel rotates at a substantially lower rate than does the right wheel, thereby pivoting the vehicle about the pivot point P, located inward of the left front wheel as hereinabove described.

FIG. 18 illustrates a drive system for a vehicle in which the king post and pivot point P′ are located directly over the left front wheel. The drive system of FIG. 18 is generally similar to that of FIG. 16 except that the differential **333** is more conventional. Similar parts in FIG. 18 are identified by the same reference numerals used in FIG. 16. When the vehicle's king post is located directly over the left front wheel, and the drive system of FIG. 18 is used, the vehicle may be swung about the pivot point P′ by merely locking the left front wheel, as by means of brake **243**, while the right front wheel is driven through the differential gearing **333**.

When the vehicle is swung about the pivot point P (or P′), the center of gravity remains within the triangulation formed by the two spaced-apart front wheels and the rear wheel assembly. This is illustrated in FIG. 20, where the triangulation referred to above is indicated by the dot-and-dash lines marked T. The king post **75** and pivot point P are indicated as being located on the line which joins the centers of the front wheels, and somewhat inward from the left front wheel. The locations of the centers of gravity for the vehicle illustrated in FIG. 5 and in other figures, of the present application, under the different conditions to be defined below, are indicated by the small circles identified by the reference numerals **91**, **92**, **93** and **94**.

Circle **91** represents the center of gravity under full load when stacking. Full load may, for example, be 15,000 pounds. Stated another way, the location of the center of gravity of the vehicle with maximum load when in the forward position is indicated by circle **91**.

When the vehicle, with full load, is moved from the forward or stacking position to the tuck or stow or carry position, the center of gravity moves rearwardly along the line **95** to the location indicated by circle **92**. Conversely, when the fully loaded vehicle swings from the tuck position to the forward position, the center of gravity moves forward from **92** to **91**. Note, however, that the center of gravity remains within the triangulation T. This characteristic of the vehicle is very important, for it indicates that the vehicle is stable when fully loaded in any position between forward and tuck.

The centers of gravity for the vehicle when empty are indicated by the circles **93** and **94**, **93** being the location of the center of gravity of the empty vehicle when in the forward or stacking position, and **94** being the location of the center of gravity of the empty vehicle when in the tuck or carry position. Again, the centers of gravity are within the triangulation T, indicating that the vehicle is also stable when carrying no load.

If, when the vehicle is swung from forward to tuck position, or vice versa, the load is heavy and the ground or floor is level, there will be little or no change in the position of the load as the vehicle swings thereunder, or out from thereunder. On the other hand, if the load is light, or if the ground or floor slants, there will be a tendency for the load to move in the same direction of rotation as the vehicle. To assure that the load remains stationary, relative to ground, when the vehicle is swung, automatic means are provided to drive the mast M rotationally when the vehicle is swung. Such means will now be described.

Referring again momentarily to FIGS. 16 and 18, it will be seen that in each of the systems shown in these figures, in addition to driving the front wheels of the vehicle (through the shafts and gearing illustrated and described), the drive motors **30** also drive a gear **82** which drives a hydraulic pump **80** through a clutch **81**. Clutch **81** may preferably be an electrically operative magnetic clutch, operable by the operator of the vehicle to engage the clutch and drive the hydraulic pump **80** when the vehicle is to be swung from forward to tuck position, or vice versa. Pump **80** is connected, by fluid conduit lines not shown, to fluid motor **79** which drives the worm shaft **78** through coupling **74**. The gear **82**, pump **80**, fluid motor **79**, worm **77**, and worm wheel **76** are so designed, and have such relationship to each other, that for each revolution of the driven right front wheel RFW, the king post **75** will be rotated a finite degree of rotation in a direction opposite to that in which the vehicle is being swung, so that when the vehicle has, for example, swung from the forward to the tuck position, through an arc of 90° about pivot point P, there

will be 180° between the vehicle and the load, as measured along the projected swing arc of the vehicle.

Instead of driving the king post **75** from the pump **80** through the worm and worm wheel arrangement, as illustrated in FIG. 6 and described above, the king post **75** may be driven by a hydraulic system, such as is illustrated in FIG. 19.

Referring now to FIG. 19, mounted in coaxial alignment with the axis of king post **75** (which is also the pivot point P) is a fluid rotary actuator **85**, supported on housing **71** and having a shaft **86** connected to king post **75** for driving the post **75** angularly through the desired number of degrees of rotation. Inserted in the fluid conduit lines between the pump **80** and the rotary actuator **85** is a manually operable compensating control **84**, consisting of a fluid differential **87** driven by a fluid motor **88**. When the compensating control **84** is in normal condition, the differential **87** functions as a direct connection and the drive motors **30** drive gear **82**, which in turn drives the pump **80** through the clutch **81**, and the pump **80** drives the rotary actuator **85**. The gear **82**, pump **80** and the actuator **85** are so designed in relation to each other, and in relation to the front wheel drive, such as has been described in connection with FIG. 16, that for each revolution of the right front wheel RFW, the king post **75** is moved through a finite degree of rotation so that for each degree of rotation of the vehicle along its swing arc, the mast M and the load on the fork are moved one degree of rotation in the opposite direction relative to the vehicle. For example, when the vehicle is swung through an arc of 90° from the forward to the tuck position, the load is rotated by the driven king post through an arc of 90° in the opposite direction.

The purpose of the compensating control **84** is to allow the operator of the vehicle to compensate for wheel slippage. It will be understood that if the driven right front wheel slips on the ground or floor and fails to swing the vehicle through the designed angular movement for each revolution of the wheel, the angular separation between the vehicle and the mast will depart from that intended, and the load will tend to move angularly relative to ground. When the operator observes that the load is tending to swing away from its intended stationary position, he operates the manual control **89** to operate the fluid differential **87** and the rotary actuator **85** is, as a result, driven at either a slower (or faster) rate of rotation.

FIG. 17 is a schematic illustration of one form of hydraulic control system suitable for controlling the operation of a fork lift vehicle of the type illustrated in the drawings and described hereinabove. Pump **31**, shown in FIG. 1, supplies the hydraulic pressure required for certain portions of the system. It is not believed to be necessary to describe in detail the operations of the lift cylinder, nor the tilt cylinders, nor the braking or steering systems, since the present invention is not directed to these portions of the vehicle. One means by which the king post **75** and mast M are driven rotationally relative to the chassis and in an arcuate direction opposite to that in which the chassis is being driven by the right front wheel, has already been described, and the hydraulic system which is associated with such means is shown in FIG. 17 under the head "Swing System." Included in FIG. 17 in the hydraulic diagram for the "Swing System" are such elements as the driving gear **82**, clutch **81** and swing pump **80**, previously discussed. When the operator desires to swing the vehicle under the load, he operates a switch which engages the clutch **81** and energizes the solenoid K. Pump **80** drives the fluid motor **79** which drives the worm **77** and worm wheel **76** to rotate the king post **75**, thereby to rotate the mast M relative to the vehicle. Valve **96** is a fluid replenishing valve.

In order to compensate for any slippage of the wheels on the floor or other surface on which the vehicle is operating, a hydraulic differential or compensator **187** is introduced for driving the swing motor **79** either slower or faster to accommodate the slip error. The pump motor **97** for correcting this error is inserted across the closed circuit of the swing pump **80** and swing motor **79**. A separate hydraulic motor **98** drives the differential pump **97** and is controlled by a manual valve **189** which selects faster or slower movement, as required to compensate for any slip errors. To avoid the necessity of moving the lever of hand valve **189** in different directions for the swing forward and tucking operations, a direction corrector valve **99** is inserted in the line to reverse automatically the fluid flow predicated on which direction the mast M is being moved.

While the swing system in FIG. 17 shows the system described hereinbefore which employs worm **77** and worm wheel **76** to drive the king post, it is to be understood that in lieu thereof a rotary actuator **85** may be employed, as described in connection with FIG. 19.

While in its preferred form, the vehicle has two front wheels and only a single tail wheel assembly (preferably a 3-unit tail wheel assembly), it is to be understood that the vehicle of the present invention may, if desired, be equipped with four (or more) wheels, two front and two rear, the rear wheels being pivotal and steerable, the front wheels being fixed and driven. Moreover, the two front wheels may each be driven by its own motor, electric or hydraulic.

It will be understood from the foregoing description, that the invention provides a fork lift vehicle in which the mast is cantilever suspended from a king post supported at a corner of the vehicle, the center axis of the king post being the pivot point about which the vehicle and mast are both swingable. The pivot point is located on the line between the centers of the front wheels, close to one of the wheels. The king post and mast are rotatable, by driving means, about the king post axis to pivot the fork and load relative to the vehicle in a direction opposite to that in which the vehicle is swinging, thereby to maintain the load stationary relative to ground. The center of gravity of the vehicle and load for all fork loads between zero and maximum, and for all operating positions of the chassis relative to the mast, is within the triangulation of the wheels of the vehicle, thereby requiring less counter-balancing, and enabling heavier loads to be handled by a lighter weight vehicle.

Having described my invention, I claim:

1. A fork lift vehicle comprising:

(a) a chassis;

(b) two spaced-apart front wheels, one at each front corner of the chassis, and a steerable rear wheel assembly located intermediate the side edges of the chassis

(c) a vertically disposed pivot post supported for rotation in a front corner portion of said chassis over the center of one of said front wheels;

(d) a fork lift mast having a fork for supporting a load;

(e) cantilever support means mounted on said pivot post for supporting said mast to one side only of said pivot post;

(f) drive means for driving one of said front wheels in one direction at one speed and the other of said front wheels in a second direction at a different speed from said one speed, thereby to swing said vehicle about the axis of rotation of said pivot posts;

(g) means for rotating said pivot post in a direction counter to that in which said vehicle is swung for maintaining the fork-supported load substantially stationary relative to ground while said vehicle is being swung about said pivot post so that the center of gravity of the vehicle is located within the triangulation formed by the said two front wheels and

said steerable rear wheel assembly for all fork loads from zero to maximum and for all operating positions of the chassis relative to the mast.

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